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CONSULTING ENGINEERS

MEMORANDUM

To: Mr. Ken Gates
Cordova Electric Cooperative, Inc.

Date: October 17, 2006
Project No: 054067.01

Cc: Mr. Danny Ackmann, CEC

From: Mike Hartley, P.E.

Subject: Humpback Creek Hydroelectric Facility Inspection and Assessment

A field inspection trip was performed for the above-referenced project with travel occurring on October 12 and 13, 2006 and field inspection occurring on Friday, October 13, 2006. PND met with Kerry Jager from Pacific Blasting to perform a final inspection of the rock stabilization. PND also inspected the micropile construction work in progess that is for use in installation of a new penstock structure to replace the existing wood flume.

In addition to these inspections PND also performed a site assessment of infrastructure damage from the 22 inches of rain received in two days just prior to my field trip. This report also briefly summarizes our assessment thoughts on repair versus demolition of damaged infrastructure from the recent flooding.

Rock Stabilization
Rock stabilization at the project site consisted of scaling and rock bolting of the rock slope downstream from the bridge and just upstream from the bridge. Rock scaling and bolting was performed by Pacific Blasting and a final inspection was performed with Kerry Jager. All work performed on this phase of the project appears to have been perform in a professional manner. Photos 6 to 9 show the work completed in this area. Due to permitting restrictions blasting was not conducted as part of the project and several large boulders were lowered using cables to prevent damage to the penstock. The work consisted of clearing, limited grubbing, rock scaling and bolting using resin and grout. Rock bolting from 4 to over 22 feet was performed depending on the requirements for stabilization. Following completion of the rock bolting debris removal adjacent to the penstock was completed. A limited number of timber boards were reinstalled to protect the steel pipe and a limited number of steel grates and segments of handrail were replaced to allow safe passage on top of penstock upstream from the bridge. At the time of inspection a few sections of grate had not been replaced and were scheduled to be completed prior to demobilization by the contractor.

PND discussed with Danny Ackmann from CEC the need to re-install some of the cut-up logs on the section just prior to the bridge (right side of penstock in Photo 6). There is a substantial amount of cut-up timber that could be placed on the uphill portion adjacent to the penstock to provide additional protection from loose rock falling on the pipe.

PND also discussed with Ken Gates and Danny Ackmann the need to perform periodic inspections. Our recommendation is that at a maximum these inspections should occur at each periodic dam safety inspection. The inspection should be used to determine if any loose rock is present from additional freeze-thaw. The inspection should also be used to determine if any larger segments have become a

hazard that may require additional rock bolting. It was also mentioned that should any earthquakes result in rock instability it may be necessary to perform inspections immediately following an earthquake to assess the need for additional repair work. Photos of the completed rock stabilization are presented in the attachment.

There is one area that has been identified as stable but should be monitored carefully. The rock stabilization conducted prior to the bridge (approximately midway) contains one section with a rock bolt installed near the toe of a larger block. The current configuration is stable with this rock bolt. Additional bolting could not be conducted since all rod stock was used during the installation. Although considered stable future monitoring should be performed at each periodic inspection of the site to determine if additional scaling or bolting may be required at this area (area shown in right side of Photo 6).

Micropiles

Micropile installations were being constructed by Bell Pacific, a division of Pacific Blasting from Burnaby, British Columbia. This work was started less than one week ago and significant progress was being made. Photos 11 and 12 depict this work. The majority of micropiles appear to be installed from 25 to 40 feet. CEC is monitoring the depths on a daily basis and will prepare as-built plan of each pile bent as work progresses. Installations appeared to be performed according to the plans and specifications with the exception of the requirement to minimize the number of wood flume brace removals. PND had originally indicated on the design documents that only enough top braces should be removed to allow movement of the micropile drill equipment and as equipment moved up the wood flume these braces should be replaced during construction for safety reasons. We discussed this with CEC personnel and Bell Pacific was planning to reinstall these braces and change construction practices.

Damage assessment

Existing Bridge

The existing bridge has had the right abutment fill scoured (see Photo 1). In addition approximately 12-inches of scour has occurred at the center bridge support (see Photo3) and significant log debris is present on the upstream side of the bridge (See Photo 2).

Work Required: The log debris should be removed as soon as possible to prevent flood damage from any additional storm events that occur. Gravel fill material should be placed adjacent to the bridge abutment and additional riprap armor may be needed upstream and downstream from the bridge. Once the timber is removed additional work may be discovered. The center support, on the upstream side, should be checked to determine if any additional scour occurred that could warrant placement of additional fill or riprap at this location.

Hydro Facility Building

One transformer was transported approximately ½-mile downstream and the other had the bank undercut and is resting in the stream (see Photo 4). Both will need to be removed from the creek.

Significant scour, up to 10 feet deep and 20 to 30 feet in areal extent has occurred adjacent to the building as shown in Photo 5. Armor rock along the stream at this location was approximately 2 feet in diameter. Existing gravel may need to be excavated and placed closer to the building and new riprap of larger dimension installed to provide more suitable protection from flood events. The armor should be approximately a D50 size of 3.5 feet; a D100 size of approximately 5.5 to 6 feet. The armor thickness should be approximately 1.5 times the maximum size. Armor should be placed in a manner suitable for protection of the building foundation to minimize potential for future scour.

Photo 5 shows the existing cmp pipe upstream from the building. Most of the gravel over this pipe has been scoured and a concrete collar near the end of the pipe prevented a complete failure. Additional armor rock and fill is needed to properly protect the pipe from future events as indicated for the building.

Spillway and Intake Structure

The spillway and instake structure have been damaged to a point that in our opinion it is beyond repair. We would recommend that damaged steel be cut up and removed from the stream. This can be stockpiled on shore for later removal or if done in time the helicopter that will be used to demobilize Bell Pacific's equipment in the next week or two could be used to remove the materials.

We would also recommend removing as much of the timber spillway structure as safely feasible at this time.

Should CEC still wish to use this facility as a hydroelectric project we would recommend consideration be given to construction of a new concrete dam facility directly upstream from the existing timber spillway and intake structure. This structure would likely consist of:

- Removal of loose bedrock to more competent rock.
- Installation of rock anchors to stabilize existing rock
- Installation of a concrete gravity dam of approximately 10 feet height.
- Installation of two radial gates to allow control of water and flushing of bedload through the structure.
- Installation of steel plate to control abrasion of the dam
- Installation of a traveling hoist that could be used to remove log debris.

This in concept is a structure that could be used to replace the existing structure. PND has not performed sufficient work on this to provide any estimate of cost for construction at this point and this is considered preliminary. Additional work would be required to analyze the suitability including geophysical work to assess bedrock depth at this location prior to providing a more definitive cost estimate.

Log Crib Dam

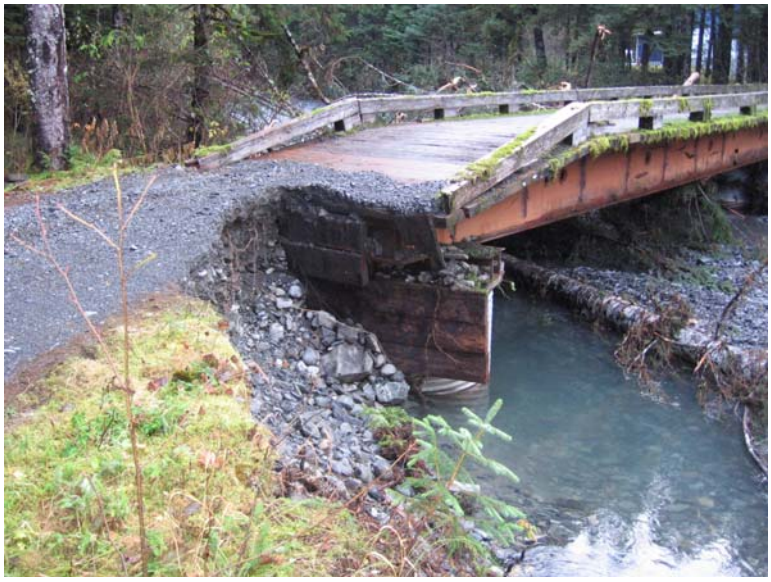
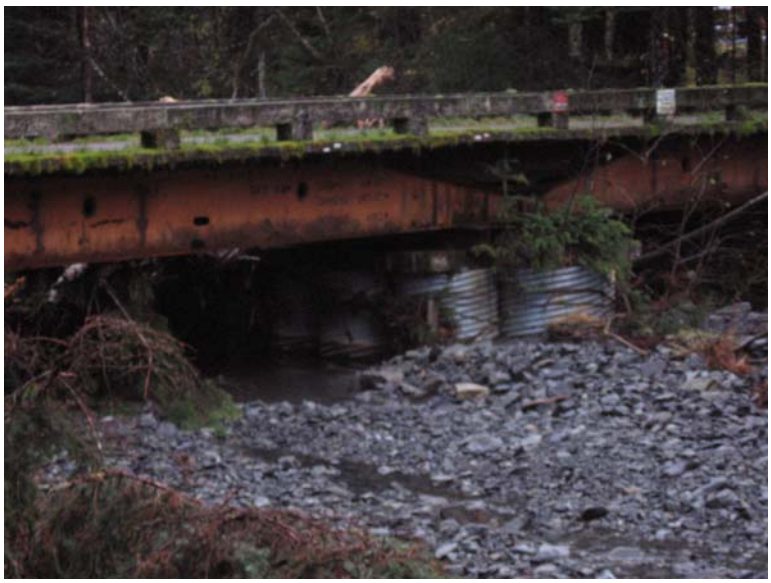
The existing log crib dam did experience some damage on the left side of the dam but could not be assessed fully due to the high water level during our field trip. This should be assessed further after water flows are somewhat lower.

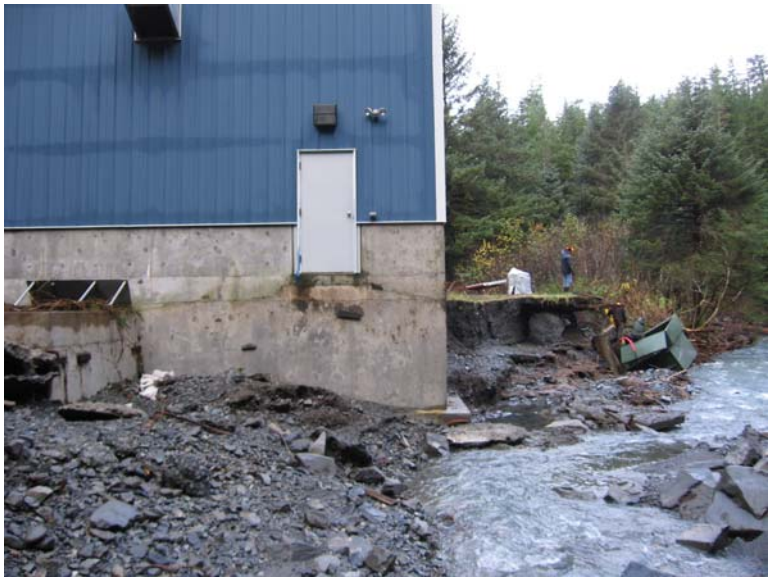
Should you have any questions please call at your convenience.

Sincerely,
PND Incorporated

Mike Hartley, P.E.
Vice President

Attachments: Site Photos

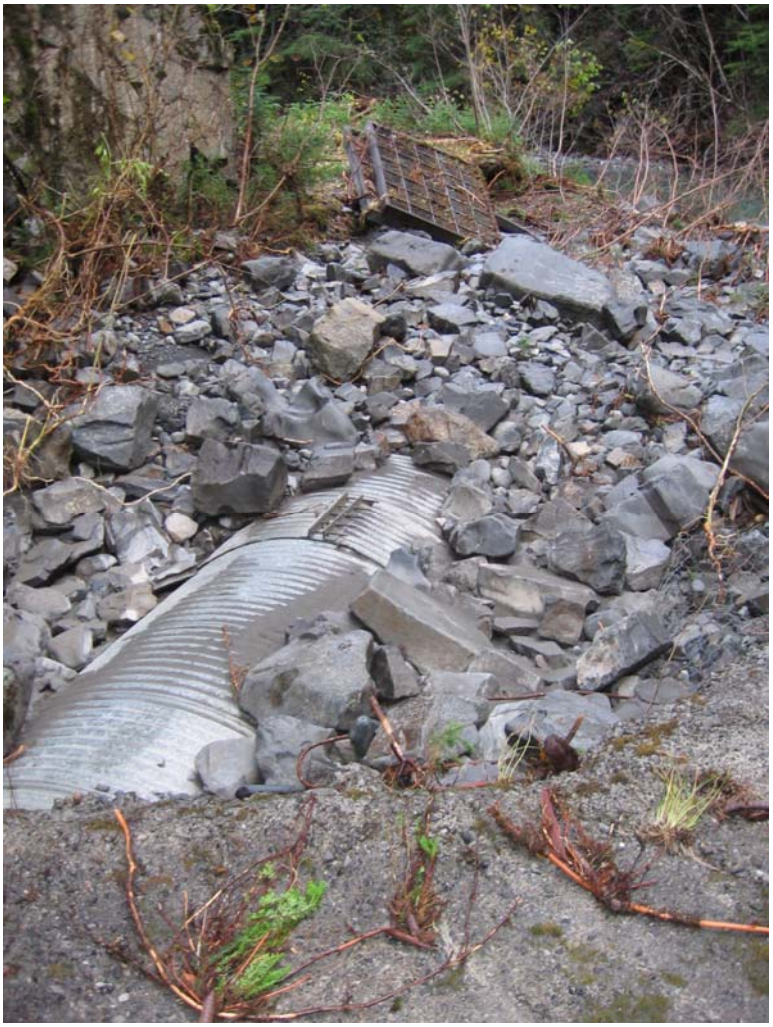
	**Photograph No. 1** **Description:** **Right abutment scour.**
	**Photograph No. 2** **Description:** **Upstream edge of bridge with log jam.**
	**Photograph No. 3** **Description:** **Approximately 12-inches of scour at center span support. Possibly more may be present at upstream end but could not be inspected.**



Photograph No. 4

Description:

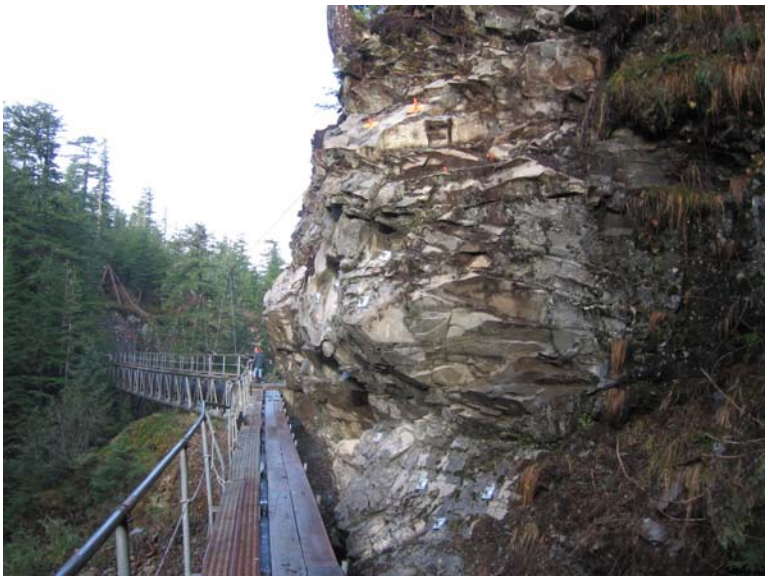
Approximately 10 feet of scour occurred along with loss of riprap and gravel at power plant. Note transformer in river. Second transformer approximately ½-mile downstream.

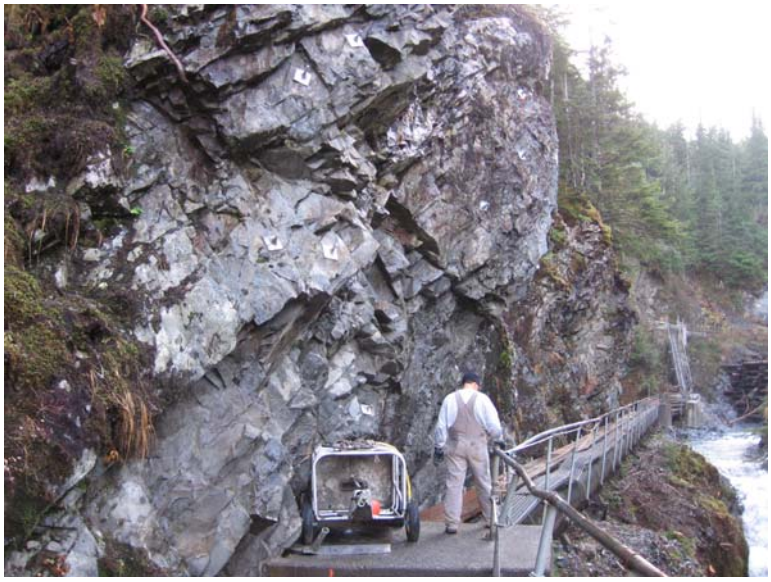
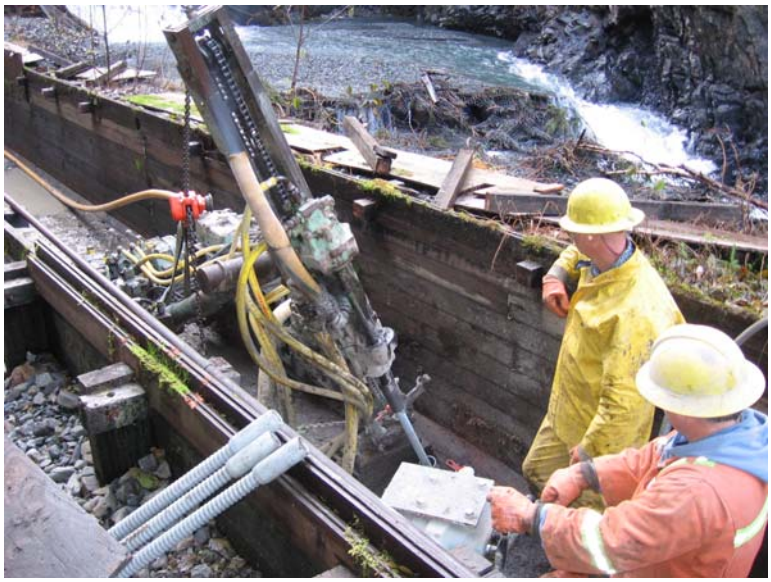


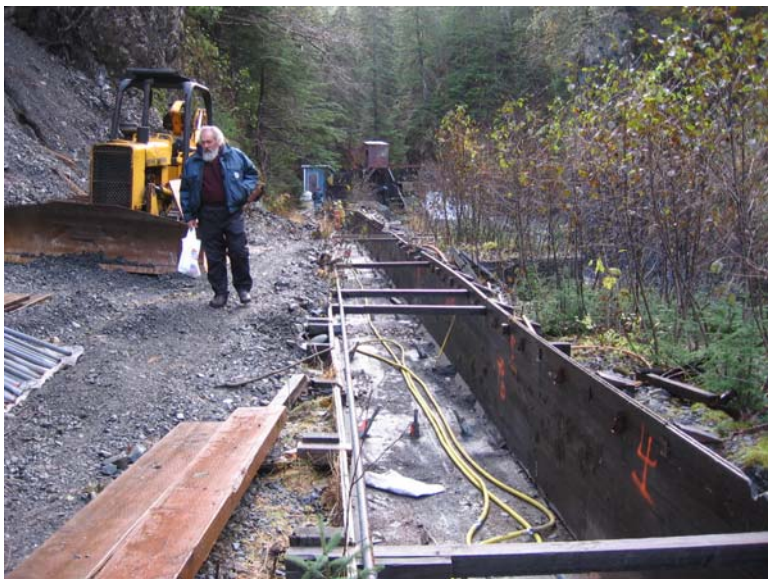
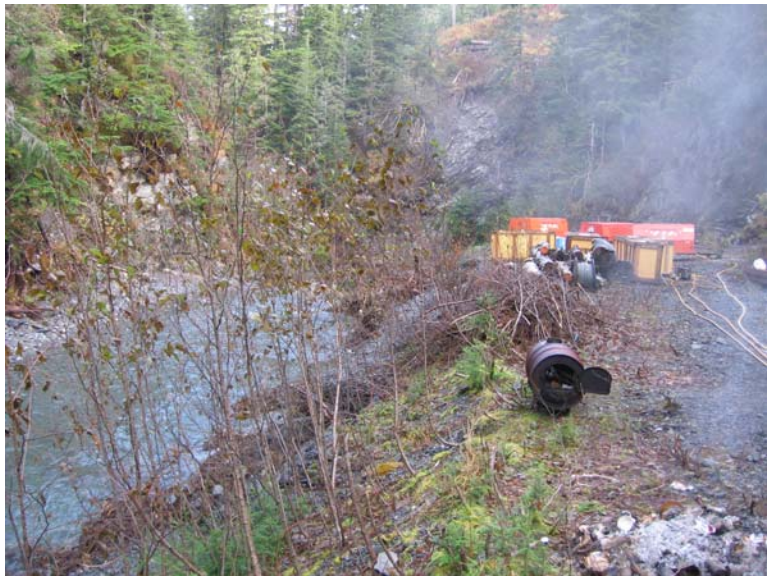
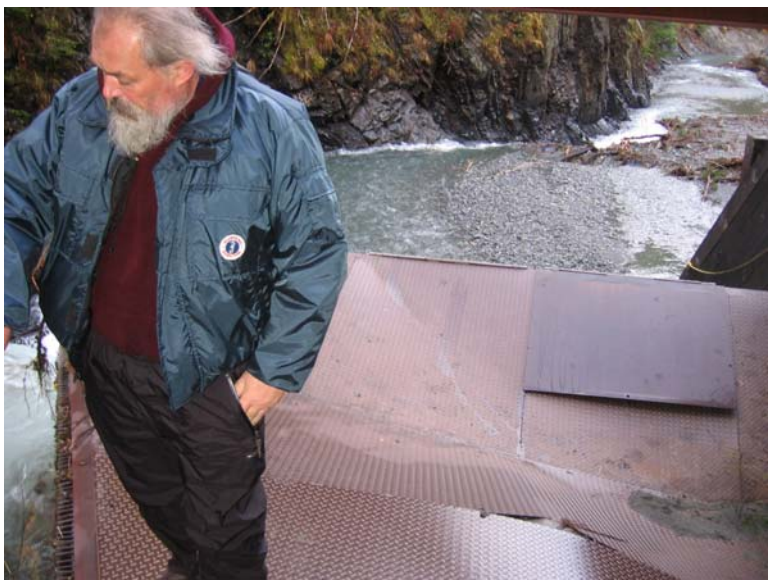
Photograph No. 5

Description:

Intake at power plant has had substantial gravel scoured from cmp pipe.

	**Photograph No. 6** **Description:** **Rock stabilization construction final inspection with Pacific Blasting was conducted as part of this trip. This area is just prior to the bridge. Cut timbers should be installed for added protection from future rock fall.**
	**Photograph No. 7** **Description:** **Rock bolting conducted just prior to bridge.**
	**Photograph No. 8** **Description:** **Scaling and rock bolting completed upstream from bridge.**

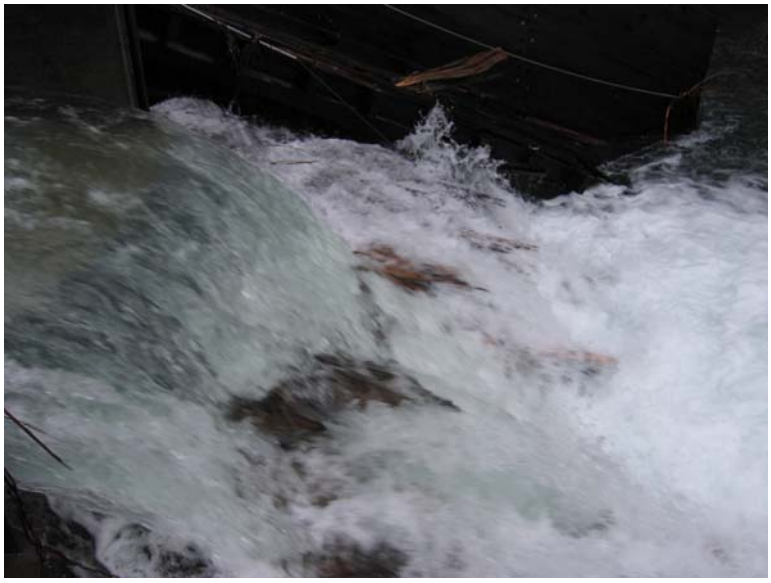
	**Photograph No. 9** **Description:** **Rock slope stabilization completed upstream from bridge.**
	**Photograph No. 10** **Description:** **Left abutment of log crib dam has lost some timbers.**
	**Photograph No. 11** **Description:** **Micropile installations currently being constructed to replace wood flume.**

	**Photograph No. 12** **Description:** **View along wood flume with micropile supports partially completed.**
	**Photograph No. 13** **Description:** **View of right stream bank above log crib dam. Some additional scour has occurred.**
	**Photograph No. 14** **Description:** **View of damage to intake screen metal top.**

Photograph No. 15

Description:

View of inside of intake. Boulder damaged supports for metal cover and damaged timber supports.



Photograph No. 16

Description:

Wooden spillway has sustained significant damage from recent event.

Photograph No. 17

Description:

View of right side of timber spillway. Note damage to underlying timber supports and top deck.